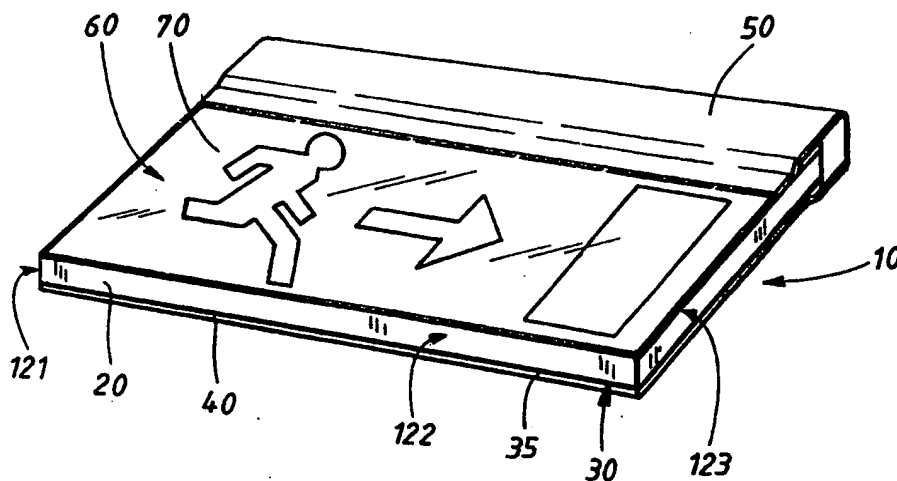




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G09F 13/18	A1	(11) International Publication Number: WO 99/03086 (43) International Publication Date: 21 January 1999 (21.01.99)
(21) International Application Number: PCT/SE98/01355 (22) International Filing Date: 8 July 1998 (08.07.98) (30) Priority Data: 9702643-9 8 July 1997 (08.07.97) SE (71) Applicant (for all designated States except US): LISOL SCANDINAVIA AB [SE/SE]; P.O. Box 197, S-503 08 Borås (SE). (72) Inventor; and (75) Inventor/Applicant (for US only): HALLAMAS, Lars [SE/SE]; Gångstigen 10, S-518 31 Sandared (SE). (74) Agents: GRAUDUMS, Valdis et al.; Albihns Patentbyrå Göteborg AB, P.O. Box 142, S-401 22 Göteborg (SE).	(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report. In English translation (filed in Swedish).	

(54) Title: ILLUMINATED DISPLAY MEANS



(57) Abstract

An illuminated display unit (10) comprising a light guide (20) in the form of a plate, one or more light sources (100) and also one or more recesses (80, 90) arranged along at least a first edge (110) of the light guide (20). The light guide (20) has a first side (60) which faces towards an observer and also a second side (30) which faces away from an observer. The light sources (100) are connected to the light guide (20) by the light sources (100) being mounted in the recess(es) (80, 90). The edges (121, 122, 123) of the light guide are coated with reflective material. The light guide (20) also comprises a matted surface (35) arranged on the second side (30) of the light guide. The display unit (10) has a reflective layer (40) arranged on the matted surface (35) of the second side (30) of the light guide. A transparent information carrier (70) may be arranged on the first side (60) of the light guide (20).

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Illuminated display means

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TECHNICAL FIELD

The present invention relates to an illuminated display unit, for example a sign for displaying information, according to the preamble clause of Patent Claim 1.

10

STATE OF THE ART

An illuminated display unit is described in EP-B-0 306 659. It consists of a light guide in the form of a plate which is connected to one or more light sources. As the
15 light source, use is preferably made of broad-beam light-emitting diodes of 3 to 4 different wavelengths (for example blue/green, yellow and red). The light is guided into the light guide through drilled or milled recesses in the light guide. In this way, the light source is
20 positioned inside the distribution material. Highly reflective so-called mixing chambers are arranged before the light is reflected out into the light guide so as to mix the monochrome light from the light-emitting diodes to form light with a broader waveband which the eye
25 perceives as white light. The edges of the light guide are coated with reflective layers which reflect the light back into the light guide until the desired angle of reflection is obtained. The repeated reflections contribute to the colour mixing of the light. The light-
30 guide plate is arranged in front of a contrast surface, seen from that side of the display unit which is to be looked at during use. On that surface of the light-guide plate which faces the contrast surface, a display symbol (or other information) is arranged.

35

A disadvantage of the technique described above is that it allows inadequate control over where and in which direction the light is reflected out of the light guide. The light scatter over a relatively large area of the
40 light guide may therefore be very uneven.

DESCRIPTION OF THE INVENTION

It is therefore a general object of the present invention to provide an arrangement which, by virtue of a simple
5 construction, provides improved light scatter over a relatively large area of a light-guide plate by increasing the control over where and in which direction light is reflected out of the light guide.

10 According to the present invention, this object is achieved by the display unit according to Patent Claim 1.

Preferred embodiments according to the present invention are described in the subclaims.

15

BRIEF DESCRIPTION OF THE FIGURES

The invention will be illustrated more fully below by descriptive examples and also with reference to the appended figures, in which:

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Fig. 1 is a diagrammatic perspective view of a display unit according to the present invention;

25

Fig. 2 is a diagrammatic, partially cut-off plan view of a part of the display unit according to Figure 1;

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Figs 3A and 3B are diagrammatic perspective views of two different embodiments of recesses in a light guide according to the present invention, and

35

Fig. 4 is a diagrammatic plan view of a light guide according to the invention showing the position of the light sources.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a display unit 10 according to the present invention. The display unit comprises a light guide 20,

advantageously designed as a thin rectangular plate. To prevent light leakage at the edges 121, 122, 123 of the light guide and also to increase reflection in the light guide 20, the edges 121, 122, 123 of the light guide are coated with reflective layers. The light guide 20, and thus the whole display unit 10, can be made very thin, a typical value being a thickness of 12 mm.

On a first side 60 of the light guide, defined in this case as that side which is to be looked at during use of the display unit 10 and therefore is to display some form of information, an information carrier 70 is arranged, through which light from the light guide 20 shines. The information carrier 70 may consist of a transparent or opaque sheet with varying contrast patterns, a screen-printed pattern or the like. If the light is to be coloured in part, for example in the case of representation of pictograms, a transparent or opaque coloured layer is advantageously arranged on those parts of the surface of the light guide which are to display coloured light. This layer therefore serves as a coloured filter.

Fig. 2 shows a cross-section of a display unit 10 according to Fig. 1.

According to Figs 3A, 3B and 4, light sources 100 are arranged along a first edge 110 of the light guide 20. The light sources are mounted in one or more recesses 80, 90 which are, for example, drilled or milled directly into the light guide 20, and the illumination therefore takes place laterally into the light guide. A number of monochrome light sources 100 are therefore arranged in a recess 80, 90, the light emitted from each of the light sources being mixed by reflection in the light guide to form light that is perceived as white by the eye of an observer. This light is then guided onward into the light guide 20.

According to the invention, the surface 35 of a second side 30 of the light guide is matted, which side is defined as that side which is opposite the first side 60 of the light guide. This is shown in Figs 1 and 2. This matted surface 35 makes it possible to reflect the light out at the desired place in the light guide 20 and in the desired direction from the light guide. Matting is carried out either mechanically, for example by grinding or applying a matted layer, or chemically, for example by etching.

As a result of the matting, the angle of reflection of the light waves will be broken up sufficiently to make it possible to guide the light with the desired direction and extent. The result of this is that the light scatter over the surface of the entire light guide 20 can become more uniform. Sufficient diffusion is achieved in the matted surface 35 of the second side 30 of the light guide for a uniform white light to be displayed without diffusion in additional layers being required. A diffusing layer may nevertheless be applied to the light guide if necessary. The colour exposed is thus controlled by the wavelength or the combination of wavelengths of the monochrome light sources 100.

The second side 30 of the light guide is then covered by a completely reflective layer 40, for example a mirror or a white-painted sheet.

The light sources 100, preferably broad-beam light-emitting diodes which emit light of one or more different wavelengths, for example of 3 to 4 different wavelengths (for example blue/green, yellow and red), are advantageously supplied with high voltage directly from the electric mains (not shown in the figures). The diodes are connected in series and are supplied with a limited current intensity. This method results in lower power consumption than the alternative method where either each diode is supplied separately, that is to say connected in

parallel with the other diodes, in which case the mains voltage has to be transformed down, or the diodes are arranged in clusters which consist of series-connected diodes but the various clusters are connected in parallel
5 to the mains voltage and this voltage has to be transformed down in this case also.

The reflective coating of the edges 121, 122, 123 of the light guide 20 may advantageously be designed with one or
10 more light outlets so as to illuminate objects situated close to said display unit. The light outlets may consist of unpainted parts of the edges 121, 122, 123 or parts where the coating has been scraped off. The light outlets allow a given amount of the light in the light guide 20
15 to leave the light guide in order to illuminate, for example, a door opening located below the display unit. The light source for this light is advantageously light-emitting diodes mounted in the same series connection as the diodes that illuminate the information carrier of the
20 display unit.

A display unit according to the invention is characterized by extremely low power consumption, the value typically lying between 0.8 and 1.5 W which may be
25 compared with conventional technology where use is made of strip lamps which have a power consumption of 15 to 20 W. The uniformity of the light intensity measured over the entire luminous sign surface is also very good, a typical value being a ratio of 3:4 between the side
30 located furthest away from the light sources and the side closest to the light sources. Furthermore, the unit is maintenance-free for a very long time - longer than 10 years may be anticipated. A display unit according to the invention moreover satisfies all the requirements in PREN
35 1838 that are relevant to the construction and the application.

It is understood that the present invention is not limited to the embodiments described above and shown in

the accompanying figures but may instead be varied within the scope of the attached patent claims. For example, a double-sided display unit may be envisaged, in which therefore the reflector layer on the rear side of the single-sided sign is omitted and a layer which reflects some of the light inwards towards the light guide and also diffuses the rest of the light away from the light guide is mounted either on the same side as the matted surface of the light guide or on the opposite side of the light guide. An embodiment with battery backup is also possible, in which the display unit is then supplied, during battery operation, with a controlled voltage instead of controlled current intensity.

PATENT CLAIMS

5

1. An illuminated display unit (10) comprising a light guide (20) in the form of a plate, a first side (60) of the light guide (20), which first side (60) faces towards an observer, a second side (30) of the light
10 guide (20), which second side (30) faces away from an observer, one or more light sources (100), one or more recesses (80, 90) arranged along at least a first edge (110) of said light guide (20), where said light sources (100) are connected to said light guide (20) by the light
15 sources (100) being mounted in said recesses (80, 90), and also where the edges (121, 122, 123) of said light guide are coated with reflective material, characterized in that said display unit (10) comprises a matted surface (35) arranged on said second side (30) of the light
20 guide, and also a reflective layer (40) arranged on the matted surface (35) of said second side (30) of said light guide (20).

2. A display unit according to Claim 1,
25 characterized in that said light sources (100) comprise broad-beam light-emitting diodes which emit light of one or more different wavelengths.

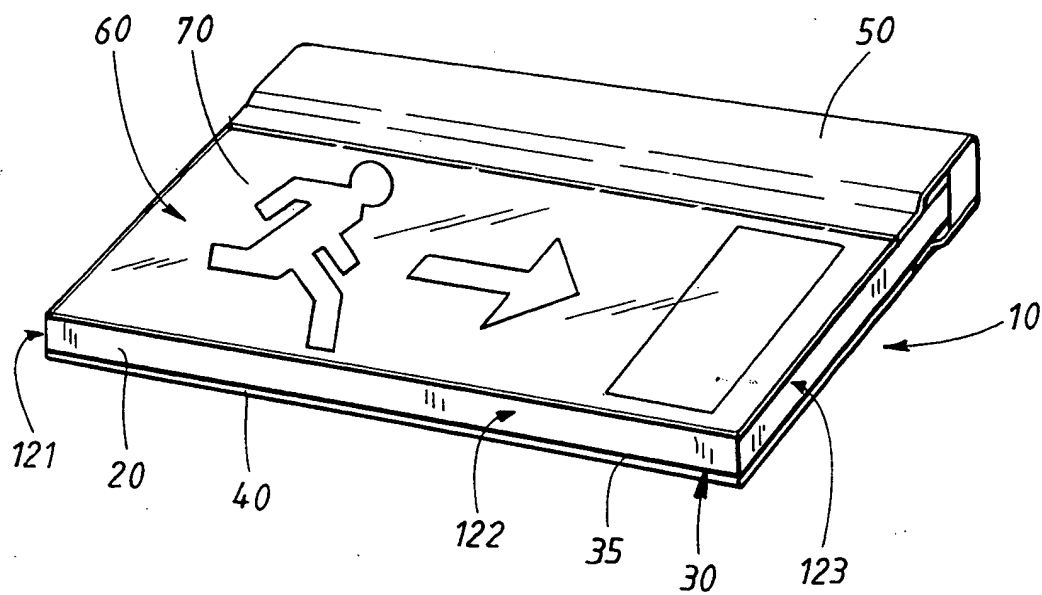
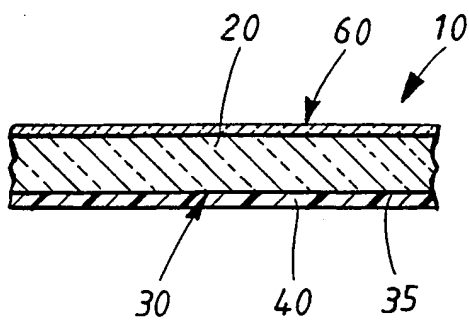
3. A display unit according to Claim 2,
30 characterized in that said light sources (100) comprise broad-beam light-emitting diodes which emit light of 3 to 4 different wavelengths.

4. A display unit according to any one of Claims
35 1-3, characterized in that said display unit (10) comprises a transparent information carrier (70) arranged on said first side (60) of said light guide (20).

5. A display unit according to any one of Claims 1-4, characterized in that the reflective coating of the edges (121, 122, 123) of said light guide (20) comprise one or more light outlets in order to allow light to
5 leave the edges of said light guide so as to illuminate objects situated close to said display unit.

6. A method of manufacturing a display unit according to any one of Claims 1-5, characterized in that
10 said second side (30) of said light guide (20) is treated by either mechanical working or chemical processing so as to produce said matted surface (35) of the second side (30) of the light guide (20).

1/2

FIG. 1FIG. 2

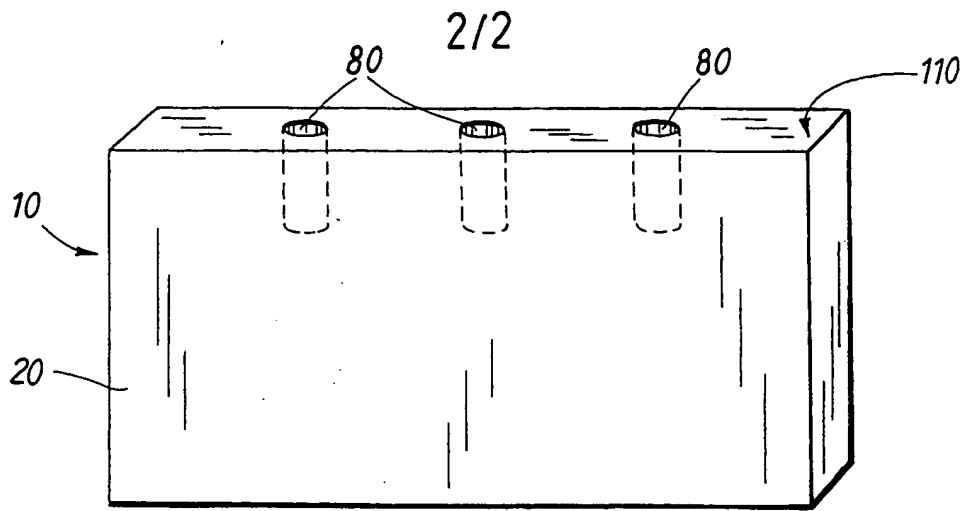


FIG. 3A

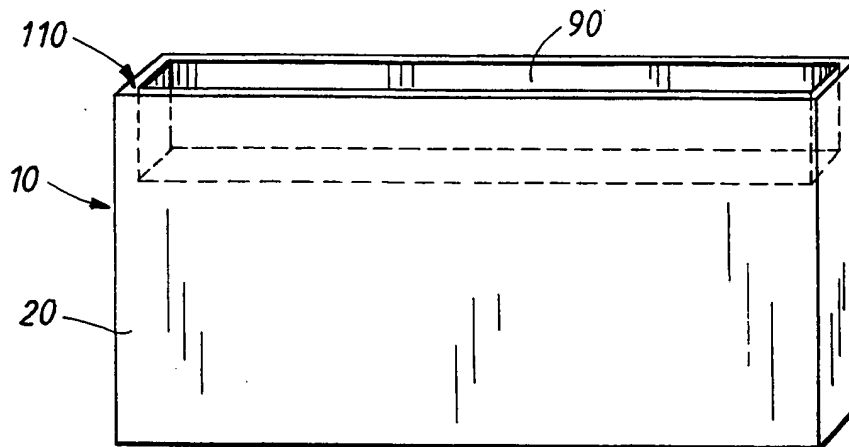


FIG. 3B

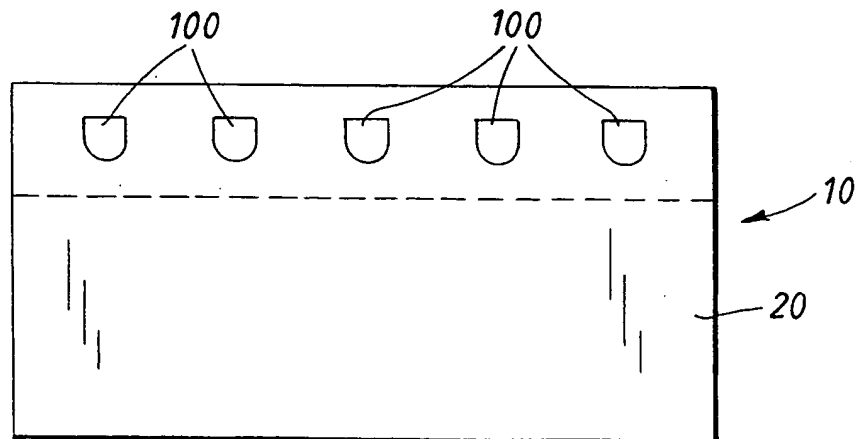


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 98/01355

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G09F 13/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC6: G09F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0306659 A2 (INOTEC GMBH GESELLSCHAFT FÜR INNOVATIVE TECHNIK), 15 March 1989 (15.03.89) --	1-6
A	US 1364916 A (D.B. CARSE), 11 January 1921 (11.01.21) --	1-6
A	US 2634530 A (R.L. HERSCHEDE ET AL), 14 April 1953 (14.04.53) -- -----	1-6

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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28-09-1998

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0306659 A2	15/03/89	SE 0306659 T3 DE 3730591 C DE 3825436 A,C DE 3885977 D ES 2049228 T US 4903172 A	07/07/88 23/03/89 00/00/00 16/04/94 20/02/90
US 1364916 A	11/01/21	NONE	
US 2634530 A	14/04/53	NONE	